clouds, winds, twilight phenomena, and the "rollers"; nor could any place be found where these particular phenomena are more highly developed.

(16) With regard to the "rollers," I would say that previous studies at Saint Helena had led me to think that undoubtedly the heavy surf constituting their prominent characteristic as described by all previous observers must be due to distant winds, not necessarily storms; and that, as an earthquake wave can traverse the whole of an ocean in a day, so the heavy swell attending a hurricane or a "norther," could easily pass to Ascension and Saint Helena from the most distant parts of the North Atlantic Ocean.

Within a week the "single-roller flag," and finally the "double-roller flag" was displayed at the Garrison landing, and I found myself looking down upon the phenomenon that had so long been a mystery. The first glance showed that the character of the phenomenon had been wholly mistaken; and on subsequent inquiry I found that probably no observer of intelligence had ever undertaken the slight hardship of a solitary residence on Cross Hill for the purpose of studying the rollers.

Otherwise it would be inconceivable that some one should not ere this have recognized a feature that certainly could never be seen from the deck of a vessel or from a lower station—namely, that the rollers are essentially the deflection around to the leeward side of what would be merely a heavy swell on the windward side of the island; and that the double rollers are simply the interference of the two sets of rollers coming around the island by the right hand and by the left. A swell such as would be caused in the open sea by a trade-wind of force 4, blowing for two days over a limited part of the ocean, will, on reaching the windward side of Ascension, or Saint Helena, produce a phenomenon on the leeward side precisely such as anyone can reproduce by studying the interference of waves in shoaling spots in a small tub of water. The angle at which the rollers interfere to produce double rollers at Garrison landing is about 135°; and as you proceed further from the island to leeward, the angle diminishes. When we sailed away from the island I was able to determine the angle as being about 40° at about fifteen miles distance. It will be at once a matter of surprise that rollers are peculiar in their severity at Ascension and Saint Helena; for other islands might be expected to show similar phenomena. But the fact is that the severity of the rollers depends first on the shape of the island; second, on its size; third, on the location and character of the shoals which surround it, all taken in connection with the length and height of the original swell; so that we should not expect many islands to possess the necessary combination of peculiarities. In fact, I have thus far learned of only one other island—namely, Saint Paul de Noronha, where the roller phenomena are conspicuous. At the Island of Barbados I particularly observed an appreciable swell curl around to the leeward side of the island from both its northern and southern extremity, and was told that occasionally these (which might be so-called single rollers) would be troublesome; but the island is so shaped that before these rollers interfere and conspire together, they have dwindled into an unimportant swell.

(17) Our second approach to and passage through the doldrums, in April 1890, served to give me the clue to a satisfactory solution of the question as to how it is that the north-east trades interact at the equator—namely, whether they pile up over the doldrums and flow back as massive upper currents, according to the ancient theory; or whether they interpenetrate each other, according to Maury's theory; or whether they revolve around each other in horizontal curves, slipping past each other to the north and south; or whether they meet and conspire together in a powerful upper easterly wind, as Abercromby maintains. This question is now readily settled by recognizing that the important general features of the circulation in the lower atmosphere are as follow:—As the trades approach the doldrums from either side, there is a continual diurnal uprising and return flow taking place, so that the returning upper anti-trades are perpetually being supplied by new air, and derive scarcely any of their material from the central region of the doldrum itself. Each successive ascending mass diminishes the inertia of the matter in the lower trade wind by necessitating the descent of a little air from the anti-trade, so that the inertia of the lower trade considered as a whole is all used up by the opposition of these descending waves, some time before it can reach the doldrums. This causes the broad irregular calm space near the equator to have no horizontal motion, and only a diurnal vertical interchange. The motion of this doldrum region horizontally in either direction depends upon the balance of pressure on the great areas of moving air around it; and it can, I believe, be deduced from anemometer records from a few such island stations as Ascension and Saint Paul de Noronha. A vertical section of the trades would show them to be wedge-shaped, being shallower at the high latitudes, while the overlying anti-trades are deeper at high latitudes. In the doldrums, as high up as clouds are formed, the prevailing characteristic of the circulation is a vertical one repeated diurnally for months and years without any systematic interchange of air to the north or south.

(20) At Barbados I was able to secure a large amount of manuscript meteorological data, and was delighted to find that the magnificent system of rainfall stations developed by Sir Rawson W. Rawson, Governor at Barbados 1866-75, is still maintained by the Government; and although the number of stations had fallen from 250 to 80, yet the system remains one of the best in the world.

Cleveland Abbe.

The unfortunate appearance of "the grip" on board the *Pensacola*, when two days out from Barbados, caused our prompt quarantine on reaching Bermuda. Meteorological work at the latter place was, therefore, necessarily much abridged. Mr. Preston was, however, permitted to land with his instruments at Quarantine, Nonsuch Island; and by remaining after the departure of the *Pensacola*, he was enabled, through the courtesy of His Excellency Governor Lieut.-General Newdigate-Newdegate, to carry on the magnetic and gravity work as elsewhere, thus preserving the chain of Expedition stations unbroken.

David P. Todd.

Amherst College Observatory, Massachusetts,
March 24.

VEGETATION OF LORD HOWE ISLAND.

THERE is nothing absolutely new to announce concerning the flora of this remote islet; but what has been published is in the form of Government reports, which have a comparatively restricted circulation, and many persons who would be interested in their contents are unaware of their existence. And even when one knows of the existence of such reports, it is often difficult to procure them. Through the intermediary of Sir Saul Samuel, Agent-General for New South Wales, the library of the Royal Gardens, Kew, has just received a copy of a report on the state and prospects of Lord Howe Island, with a number of photographic illustrations of the scenery and vegetation of the island; and it is on account of some of these illustrations that I have thought it worth while making known to the readers of Nature the existence of such a report, though it was published as long ago as 1882. Unlike the majority of such documents, this report is too meagre; "Thompson's

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farm" and other matters being mentioned and illustrated in such a manner as to take for granted an amount of previous knowledge that very few readers could possibly have possessed.

Although so remote and so small, Lord Howe Island supports an indigenous flora of a highly interesting character, especially interesting because it includes some plants whose nearest allies are natives of New Zealand. The island is about 300 miles from Port Macquarie, the nearest point of the Australian mainland, in 31° 30′ S. latitude. It is seven miles long, with an average breadth of about a mile, and the basalt mountains rise to a height of nearly 3000 feet. The soil is fertile, and is, or rather was, everywhere covered with vegetation. The scenery is beautiful; the climate is described as unsurpassable, and a great future is predicted for the island as a sanatorium, "when the Australian colonies become more densely inhabited." Without waiting for the time when Australia will be crowded with inhabitants, Lord Howe Island might be made a pleasant holiday resort, involving just enough of a sea voyage to be exciting and exhilarating, and not long enough to be monotonous.

The most complete account of the flora yet published is by Mr. Charles Moore, Director of the Botanic Gardens, Sydney, N.S.W., though many of the new plants then—1869—collected by him have since been published in various books and periodicals. The dominating feature in the vegetation is composed of palms, of which there are three or four species peculiar to this island—a condition of things paralleled in remote insular floras only in the Seychelles. Next in interest and prominence are the four or five endemic species of tree ferns, which, however, we are informed, in the illustrated report referred to, by the Hon. J. Bowie Wilson (botany by Mr. J. Duff), are fast disappearing from the lowlands, and will soon be extinct if their removal is not absolutely prohibited. In this connection one is gratified to find both the chief of the Commission of Exploration, and the botanist attached thereto, strongly urging the Government to take active steps to preserve the beautiful vegetation of the island, and especially to make no concessions, nor grant any leases that might entail any further destruction of the woods. Commonest among the other trees are *Hibiscus Patersonii*, *Myoporum acuminatum*, and *Ochrosia elliptica*—all three Australian trees; one or more species of *Ficus*, and one or more endemic species of screw-pine. One of the vegetable wonders of the island is a huge banyan-tree (*Ficus* sp.), said to cover three acres of ground; but no particulars are given of this remarkable tree, beyond a photograph of a portion of it. This is rather disappointing, because of all the famous banyan-trees in India, some of which are encouraged by artificial means in the development of the aërial descending roots, which eventually become auxiliary trunks, few surpass in size this one, on such a speck of an island. The celebrated banyan between Poona and Kolapore, in the Bombay Presidency, is, indeed, the only one, of which I have found a record, that covers a greater area than the Lord Howe Island banyan, and that, according to measurements given of the spread of its branches, must cover between six and seven acres.

In striking contrast to the flora of Australia, the flora of Lord Howe Island, like that of New Zealand, contains exceedingly few species of the large natural order Leguminosæ. Out of five species collected, three are common sea-side plants that often establish themselves on a shore from seeds cast up by the waves. Of the other two, one belongs to the otherwise exclusively New Zealand genus *Carmichaelia*, and the other, *Sophora chrysophylla*, is also a native of the mountains of the Sandwich Islands, and has hitherto been found nowhere between these two distant parts of the immense Pacific Ocean, and nowhere else in the world. From the foregoing notes may be gathered what an interesting flora that of Lord Howe Island is, and it is to be hoped that the recommendations of the Commissioners for its preservation have been carried out by the Government of New South Wales.

W. Botting Hemsley.

NOTES.

At the meeting of the Royal Geographical Society on Monday, it was announced that the following awards had been made:—To Sir James Hector, M.D., F.R.S. (Director of the Geological Survey, &c., of New Zealand), Royal Medal; to Dr. Fridtjof Nansen, Royal Medal; to Mr. William Ogilvie, the Murchison grant; to Mr. W. J. Steains, the Back grant (one year); to Dr. David Kerr Cross, the Back grant (one year); to Lieutenant B. L. Sclater, R.E., the Cuthbert Peek grant; to Mr. A. E. Pratt, the Gill memorial.

The next ordinary general meeting of the Institution of Mechanical Engineers will be held on Thursday evening, April 30, and Friday evening, May 1, at 25 Great George Street, Westminster. The chair will be taken at half-past seven p.m. on each evening by Mr. Joseph Tomlinson, the President. The following papers will be read and discussed, as far as time permits:—Research Committee on marine-engine trials: report upon trial of the steamer *Iona*, by Prof. Alexander B. W. Kennedy, Chairman; on some details in the construction of modern Lancashire boilers, by Mr. Samuel Boswell, of Manchester. The anniversary dinner will take place on Wednesday evening, April 29.

At the Physical Society, on Friday, in addition to the papers already announced, an account will be given, by Prof. Silvanus P. Thompson, of erecting prisms for the optical lantern. A new prism by Mr. Ahrens will be exhibited.

The Kew Committee of the Royal Society have given notice that they are prepared to examine, at the Kew Observatory, photographic lenses, for the purpose of testing them and of certifying their performance.

The twenty-second annual meeting of the Norfolk and Norwich Naturalists' Society was held in the Norwich Museum on March 31 last, Mr. Henry Seebohm, the President, in the chair. Dr. F. D. Wheeler was elected President for the ensuing year. The Treasurer's report showed that the Society was in a sound position financially, and that the present number of members is 254. Mr. Seebohm read his presidential address, and referred to the loss the Society had sustained by the death of Mr. J. H. Gurney and Mr. John Gunn.

Writing on April 4, a Constantinople correspondent of the Vienna *Vaterland* says that, on the preceding day, the hamlet of Adil-Djevas, in the district of Van, in Armenia, had been destroyed by an earthquake. One hundred and forty-six houses had been destroyed, 240 other buildings had been much injured, and hundreds of lives had been lost.

According to a telegram sent through Reuter's Agency, a large body of water has been discovered at El Golea, in the Sahara Desert, about 120 feet below the surface. It throws up nearly forty gallons per minute at present, and it is anticipated that the yield will be much greater when more perfect access to the water is attained. The discovery is regarded as of high importance, as this is the first time that water has been found in the Sahara at such a slight depth underground.

A lady sends the following note on a meteor seen by her to pass across the sky from north-west to south-east about 7.20 p.m., March 26. It was seen from the bridge over the River Fal, at Ruanlanihorn, Cornwall:—"Body very bright, brilliant white light, towards the back a slight flame-like appearance, a slight delicate tail rather more inclined to reddish light.

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